(18)

→ Photo therapy

← UVB / UVA / photo chemo therapy / photo dynamic therapy

Introduction:

EMSP → Electro-magnetic spectrum
↓
represent Rays coming from the sun
- visible
- nonvisible

→ it is divided according to wave length to

- UV rays
  ↓
  من 400 نازل.
  ↓
  ~~400 – 340~~
  ~~340 – 320~~
  0 – 200 → X-ray, Gamma rays.
  200 – 280 → UVC (ozone hole)
  280 – 320 → UVB (BB)
  311 – 313 → UVB (NB)
  320 – 340 → UVA 2
  340 – 400 → UVA 1
  (N.B) 308 → Excimer laser
- visible light
  ↓
  400 : 700 nm.
- Infra-red.
  ↓
  700 – 1000 nm.

So photo therapy includes

- UVB
- UVA
- photo chemo therapy.
- photo dynamic therapy.

① **UVB** (280 : 320 nm) 20

- 280 : 320 nm → BB UVB (Broad band)
- 311 : 313 → NB UVB (narrow band)
- 308 → Excimer laser.

Mech of action:

1- Absorped by chromophore (Nuclear DNA).

2- ↓ DNA synthesis leading to cell cycle arrest as in psoriasis.

3- Cause immuno suppression by reducing inflammatory cytokines as (IL 2, IL 8, IFN-γ) produced by T-cell.

4- Affect Langerhans cells → alter their function (Ag presentation).

Indication of (NB UVB) :-

P
- Psoriasis. → start ε 70% MED, ↑ each time by 10-30% / 3 sessions/w.

S
- vitiligo. → start ε very low dose .1 - .2 j/cm2.

A
- Atopic dermatitis → start ε 70% MED

- pLEVA
- P.LC
- PLE.

NB

Minimal erythema dose

MED → minimal dose of UV ω can cause erythema.

② UVA (320-400 nm):-

UVA1 (340-400) nm

- Similar to UVB in the effect
- penetrate to deep structures as B.V & dermis.
- Safer than PUVA in For long term therapy.

UVA2 (320-340) nm.

Indication of UVA1:-

M = Morphea
- GVHDs (Graft versus host dis).
- Urticaria pigmentosa
- MF

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③ photochemotherapy:-

it means:- use of chemical sensitizer as (Psoralen) — topical / systemic — followed by → UVA

(PUVA)

Psoralen permit → maximum absorption of UVA

Mech of action of PUVA:-

① - Psoralen react ē DNA → this conjugation
- ē epidermal DNA → inhibit DNA replication
Cause → cell cycle arrest.

② Psoralen react ē Molecular O_2 leading to → formation of ROS (reactive oz species) Cause → cell memb damage

Indication of PUVA:-

- A Topic dermatitis.
- PRP
- Psoriasis. & palmo planter psoriasis
- Prurigo nodularis.
- D H
- urticaria pigmentosa.
- vitiligo
- GVHD.
- M.F (stage (IA, IB, IIA)
- Morphea.

Investigation before oral PUVA:-

- Renal, hepatic function tests
- CBC
- ophthalmologic ex.
- pregnancy test.

Technique:-

- determine (MPD) → minimal phototoxic dose
Administre 0.5 mg/kg of 8-methoxypsoralen.
- After 2 hrs → UVA.
- 4 times/ week.

side effects of oral PUVA:

- sunburn.
- photo damage skin.
- SCC, BCC, M.M.
- Actinic keratosis.
- PUVA lentigines.
- GIT upset & liver toxicity.

↓

So → Topical PUVA more safe
- Topical PUVA more suitable for renal & hepatic impairment.

* Technique of Topical PUVA:

- apply Methoxsalen 0.00% cream to skin
  → after one hour → U.V.A.
- 4 session /wk

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(4) Photo dynamic therapy:

→ by use of photo sensitizers to concentrate in the tumour or inflammed tissue. → then activated by ligh source.

→ Usual sensitizer is gama (ALA).
amino-levulinic acid.
taken by tumor cells.
then
~~introduction~~ by 630 nm ~~bright red light~~
destruction of tumor.

Technique:

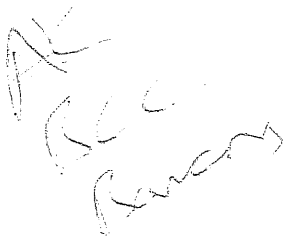
→ Apply 10-20% ALA cream for 4hrs under occlusion

→ Apply light for 15-20 minutes.

→ Repeat after 2-3 months.

Indication:

- Actinic Keratosis.
- superficial BCC
- superficial SCC.
- Bowens dis.
- ——



(platelet rich plasma) (1)

Def:-

aportion of plasma fraction of autologous blood having aplatelet concentration above base line ⟶ Abundant platelets concentrated into a small volume of plasma.

Components of PRP:-

1- The most abundant component is platelets ⟶ 5-8 folds increase in its conc.

2- leucocytes ⟶ provide anti inflamatory effects in area of injection

3- Full component of clotting factors ⟶ but in its normal conc.

Function of PRP:-

PRP containing various growth factors including:-

PDGF - platelet derived growth factor.
TGF - Transforming growth factor.
VEGF - vascular endothelial growth factor.
ILGF - insulin like growth factors
EGF - epidermal growth ~
HGF - hepatocyte ~ ~
FGF - Fibroblast growth ~

These growth factors ⟶ acceleration of tissue regeneration and collagen synthesis.

accelerate tissue Regeneral & Collagen synthesis

PRP preparation:-

- By centrifugation of blood in one or two centrifugation process.

- The two centrifugation process include:-

* Initial centrifugation → Low speed.
  separate platelet poor plasma (PPP) from RBC & PRP

* 2nd Centrifugation → high speed resulting in
  → upper portion of PPP
  → lower portion of PRP.

Clinical application of PRP:-

- Alopecia areata & Telogen effluvium androgenic alopecia
- Skin rejuvenation
- Scars → atrophic & post acne scars.
- Acute and chronic skin ulcer.
- Striae distense.

Contraindications:-

- Low platelet count
- Low Haemoglobin
- Low blood pressure - haemodynamic instability.
- Clotting disorders.
- Chronic liver disease
- Auto immune dis.
- Drug therapy that affect bleeding & clotting (aspirin)
- Infection at the site of injection
- Sever illness, or septicemia.

(Botox) Botulinum toxin. (3)

Mech:

Botulinum neurotoxins (BTX) are derived from bacteria → Clostridium Botulinum and include 7 serotypes.

- All BTX subtypes block neuromuscular transmission by binding to receptor sites on motor nerve terminals and inhibiting the release of acetylcholine

- When injected I.M at therapeutic dose → BTx produce temporary chemodenervation of the ms.

Indication:

Emerin Indication IS

* Hyperhidrosis ← axillary. palmo plantar.

* Aesthetic indication of face and neck

↓

BTx smooth hyperkinetic lines result From repeated ~~**~~ contraction of ms by Relaxing & weakening of these ms. as.

1. horizontal lines on forehead → Frontalis ms.
2. vertical lines (Eyebrows → Corrugator ms.
3. horizontal Creases across bridge of the nose → procerus ms.
4. Crow's feet ↓ Lat. lines of bony lower eye - lids → orbicularis oculi

5- Perioral lines → orbicularis oris.

6- Horizontal neck lines → platysmal bands

- effect of injection appear 1 to 2 days after injection
  ↓
  and last 3-4-6 months or

- Age:-
  → 30-50 ys → more responsive : on the wrinkles mostly due to ms. activity
  → ↑ age → loss of skin elasticity.

Contra indication:
- Allergic reaction to Botulinum toxin products.
- Skin infection at the planned injection site.
- neuromuscular disorders ex → Myasthenia gravis.
- Saftey in pregnacy, lactation, and < 18 ys
  → not yet detected.

Complication:
1 — pain ~~Bruise~~ at injection site.
2 — Hypersensitivity reaction < anaphylaxis. dysphnea urticania.
3 — weakness of ms of hand ~~of blepharoptosis~~
  ↳ in BTx for Palmer hyperhidrosis.
4 → Affect non targeted ms in areas surrounding the injection such as:-
  * eye lid → ptosis.
  * Lower eye lid laxity

* epiphora (↑ tearing)
* diplopia, eye brow ptosis.
* ↓ strength of eye closure.
* mouth incompetence, difficult speach, inability to whistle

5- Spread to toxin effect ⟶ leading to
- generalized ms- weakness.
- diplopia, blurred vission
- droping of eyelids.
- hoarseness of voice, dysarthria
- loss of bladder control.

Drug interactions:

① aminoglycosides
MS. relaxant.
Drug interfering ē neuro-muscular transmition ⟶ potentiate its effects.

② Anti cholinergic drug —ē / Botox→ will potentiate systemic anti cholinergic effect.

③ As it is a therapeutic protein → there is a potential of formation of neutralizing antibodies to Botulinum toxin type A.

④ use of least effective dose —ē / long interval→ () injections.
⟶ ↓ its immunogenecity.

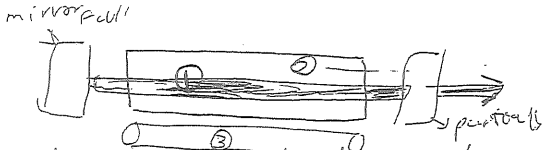
(LASER)

Def:- Light Amplification by Stimulated Emission of Radiation.

Components:

All lasers composed of 4 primary components :-

L 1- laser medium → solid or liquid or gas → laser named according to the medium.



O 2- Optical cavity :- ① surround the laser medium.
② Contain amplification process.

- Chamber → highly reflective optical cavity
- 2 mirrors → one fully reflective, one partially reflective

P 3- Power supply :- (electrical, thermal, chemical) → supply energy to laser medium.

D 4- Delivery system :- → Articulating arm & mirrored joints → to deliver the light to the target precisely.

DOPL

(7)

Laser in dermatology:

1- Ablative & non ablative

2- Vascular lasers

3- Laser hair removal.

4- Laser for pigmented skin lesion (Q.S)

5- Excimer laser: vitiligo
psoriasis.

① Ablative and non ablative laser:-

* **Ablative:**
ablative resurfacing improve skin quality by :-
- Remove all epidermis - physical removal or vaporize all epidermis.
- ± part of dermis - sometimes remove part of dermis.

* **Non ablative:-** Improve & not Removal
- improve photodamaged skin & not physical removal or vaporization of the skin.

advantage more than ablative :-
- Stratum corneum remain intact immediately after ttt.
- Re-epithelialization & wound healing rapidly & in → 24hrs
- No significant downtime.
- Safe treatment of darker skintype.

Mech :-
Ablative & non ablative ~~use~~ Water target chromph
→ Heat ↑ the tissue by using water as target chromophore
→ change in rate of heating ⟶ determine the response.

as → Temp ↑60°c → denaturation of most proteins.
→ ~ ↑70°c → denaturation of DNA.
→ 60 – 140 °c → - Vaporization of water and cell shrinkage
- memb rupture
- protein denaturation.
- collagen hyalisation.

→ Temp 300°c to 1000°c → Tissue ablasion & Smoke generation

ex:-

Ablative		non ablative		
10600	CO_2 → 10600	N	Nd:YAG	1320
2940	Erbium:YAG → 2940 nm	D	Diode	1450
		E	Erbium:Glass	1540

Indication of Ablative laser:-

- Rejuvenation.
- Acne scar ttt
- Scar revision.
- Epidermal nevus.
- Seborrheic keratosis.
- Verrouca vulgaris.
- Xanthelasma.
- tumor
  - Sebaceous gland hyperplasia.
  - Syringoma.
  - Trichoepithelioma.
- Hailey-Hailey dis.
- Darrier dis.

Side effects:-

① Erythema:-

CO_2 → 2 months.

Erbium → 1 months.

② Dyspigmentation.

- PIH
- hypopigmentation

* PIH:-

- Common during summer.
- resolve in few months.
- pre ttt & bleaching agents → ↓ risk of PIH.

↓

Summer

- Resolve
- pre ttt bleaching

- hypopigmentation:

→ Relative hypopig- of the treated skin
- when compred to untreated skin
- to decrease it :-
  - ✓ Resurfacing of the entire face or entire cosmetic unit
  - ✓ medial-depth chemical peeling of untreated areas

→ delayed hypopigmentation
↓
6-12 months after.
unexplained.

(3) Acniform eruptions:-
- in first few weeks.
- in ptn ē past ltx.

(4) Eczematous Dermatitis:-
- topical anaesthetic

(2) Vascular laser.

- P – pulsed Dye (585 - 600 nm) → 585 - 600
- N – Nd:YAG (1064 nm) 1064
- D – Diode (800 nm)
- A – Alexandrite (755)
- A – Argon. (488 - 514 nm)
- I – IPL

→ the target chromophore of vascular lesions is Hgb, oxy-Hgb - met Hgb - and clot.

→ After absorption of laser by oxy Hb → light energy converted to thermal energy.

→ thermal energy diffuse radially to blood vessel leading to microvascular damage by

- photomech. injury
- photochemical inj
- photothermal coagulation

① photothermal effect → heat → thermal damage
- light transformed to heat → thermal damage → coagulation of the target vessel.

② photomechanical: → Sudden heat, Rupture
- PDL → sudden heating → vessel wall rupture and purpura.

③ photochemical:
- pulsed dye laser mediated PDT as light source through → photo-oxidative reactions.
  - oxidation
  - cytotoxic effects.

Uses of vascular laser:-

① Vascular uses:-

1- Port wine stain. ← PDL, alexandrite & Nd.YAG → resistant cases
2- Hemangioma. ← PDL, Nd.YAG → for deep lesions.
3- Angio keratoma of Fordyce
4- Cherry angioma.
5- spider angioma.
6- venous lake.
7- pyogenic granuloma.
8- poikiloderma of civatte
9- venous mal formation
10- lymphangioma circum sciptum
11- Rosacea.
12- Telangectasia ← PDL, Diode, Nd:YAG for deep & large vessels.

(Vascular)

② Non vascular uses:-

1- psoriasis.
2- wart
3- molluscum
4- Scars → keloid & hypertrophic
5- Stria rubra.
6- DLE
7- angiolymphoid hyperplasia.
8- granuloma fasciale.

* Short waves Vs long wave vascular laser.

Long wave	short wavelength
- Better penetrate dermis.	- Heat only the Anti. vessel wall.
- Heat the Full circumference of the vessel.	- Result in incomplete thrombosis
- Results in vein closure	

side effects of vascular laser:-

P * **pigmentary changes**:-
- transient
- more in dark skin.

S * **Swelling**:- when treat vascular lesion ē
near IR laser or
ō non purpuric multiple pass PDL technique

S * **Scarring**:- ↑ē PDL but ↑ē near IR laser.
- can be minimized by performing test pulse.

U * **ulceration**:-
- risk ↑ē higher and longer wavelength.

→

(3) Laser hair reduction. (12)

(most common types)

694 R 1- Ruby (694) → high in melanin absorption limited to skin type I, II, III

755 A 2- Alexandrite (755) → for very fine hair

3- ~~Diode~~ :-

D 3- Diode :→ penetrate more deeper than Alexandrite.

N 4- ND: YAG → penetrate deeper than diode

I 5- IPL & appropriate filters → Suitable for all skin types.

Mech:-

① photo thermal effect:-

photo thermal destruction of hair follicle

② photo chemical :-

Hair destruction result when photosensitizer used & light → oxidative cell damage.

③ photomechanical:-

hair removal by photomechanical by Q-switched laser → Temporary hair loss.

↓

so this Mth is of minor relevance

Indication:-

① Unwanted hair:-

- Hirsutism.
- Hypertrichosis
- cosmetic concerns
- Hear bearing Flaps for → reconstruction

2- Diseases related to hair follicles:-

- Acne Keloidels.
- pseudofolliculitis barbae.
- pilonidal sinus.
- Dissecting cellulitis.
- Hidradenitis suppratiua
- Tricho stasis spinulosa

side effects :-

1- Discomfort & pain.

2- perifollicular erythema & odema. lasts for few hours.

3- Transient pigmentary changes < hypo / hyper pig-

4- permenant pig. changes may occur in dark skin type

5- Epidermal damage → ↑ fluence

6- Herpes simplex outbreaks in perioral & pupic area

7- paradoxical hypertrichosis-

- ↑ hair growth
- more in dark skin type III, VI.

mech:-

* suboptimal fluence induce terminal hair from vellus hair.

* hormonal cause.

8- Bacterial infection (un common).

S/T

9- scarring & textura changes in case of → aggressive tt.

10- effect on tatoo & freckles → lighting of colour.

11- plum :- d.t vaporised hair shaft.

- ~~irritate Respiratory tract~~
- smoke evacuator is recommended.

(4) Laser ttt of pigmented skin lesion & tattoo.

↓

the workhorse laser system for ttt of pigmentation & tattoing is

Q-Switched laser.
(quality switched..)

as.

RA as hairRe
- Q switched Ruby 694 nm → 694 → Rub
- Q switched Alexandrite. (755 nm) → 755 → Alex
- Q.S Nd:YAG (1064 nm) → 1064 → ND Yag
- QS Nd:YAG / KTP (532).

→ Choosen wavelength should be → specific & well absorped by Melanin.

→ In case of tattoo → target chromophore is → ink (exogenous pigment).

in macrophages. dermis.

→ in case of Bg. pig. lesions → target chromophore is → Melanin in

Melanocytes KS dermal macrophages.

Mech:

(1) photomechanical effects:-
by photo.acoustic injury

(2) photothermal effects:-
photo thermal destruction of the pigment.

Indications:-

(1) Bg. pigmented skin lesions:-

→ epidermal:-
- Ephelides or freckles.
- lentigines.
- Nevus spilus.
- Seborrhic Keratosis.
- Café_au_lait macules

→ Dermal:-
- Navus of ota.
- Navus of Ita
- Blue navi.

→ Dermo_epidermal:
- melasma
- Becker's nevus.
- PIH
-

(2) Tatto:-
→ Amateur.
→ professional.
→ Traumatic. T
→ Cosmetic. C
→ Medical. M

Side effects:

1- Alteration of pigmentation ← PIH hypopigmentation
2- paradoxical darkening of tatto
3- Inadequate response
4- localized allergic reaction.
5- tatto granuloma:- Allergic granuloma to tattoo ink.
- Common é cinnabar in red colored ink.
6- Recurrence of the lesion
7- Scarring.